Tips for city and suburban dwellers

SOIL CONSERVATION AT HOME

U. S. Department of Agriculture
Soil Conservation Service

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THE United States is becoming, more and more, an urban nation. Nearly 9 out of 10 people live in cities and towns. Urban and built-up areas occupy nearly 50 million acres.

With population growing 3 million a year, land is going out of agricultural use at a net rate of 1 million acres a year. For each new family needs, on the average, about an acre for living space, transportation, and service facilities.

This growing acreage of urban and suburban land poses new conservation problems. The information and experience gained by the Soil Conservation Service in working with farmers and ranchers can be of value to those using land for other purposes. This publication makes some of that information available to urban and suburban residents.

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Soil Conservation at Home

Tips for city and suburban dwellers

No matter where you live—in city or country—if you have a separate house with its own plot of ground, you are a "land user" in your own right.

As such, you are responsible for the care of your tract of land, whether you own it, lease it, or rent it. You have the opportunity and the need to practice soil and water conservation.

This bulletin is about conservation for the small pieces of land that surround urban and suburban homes. In it you should find hints for coping with some of the soil and water problems of your own private holding.

Good husbandry has its rewards for the keeper of a city lot as well as for the proprietors of country estates, farms, ranches, and forests.

Under All Is the Land

The first essential is to realize how dependent you are on the land. Your house rests on it. Your trees root in the soil; so do your garden vegetables, flowering plants, and lawn grasses.

The stability of your buildings and the success of your plantings, therefore, depend on the nature of your particular piece of land, its bedrock and its soils. The behavior of runoff water from rain

and snow is governed by the kind of soil and the slope and conformation of its surface.

You can lose your good topsoil by erosion, or you can have it covered by sediment eroded from the grounds of a careless neighbor. Your flower beds may be cut to pieces by the discharge from the roof gutter or by concentrated runoff from an adjoining lot or playground. So your soil and water problems are not confined within your property boundaries but are intertwined with those of the surrounding landscape.

Many of your community services and amenities, too, take their character from the land. The streets may have been laid out to conform to topography; if not, they have created special problems of drainage and erosion. Both topography and soils affect the location and cost of constructing schools, shopping centers, playgrounds, water lines, and sewage facilities. The character of parks and the presence or absence of birds and other interesting wildlife reflect the nature of the land.

City people sometimes forget how much they owe to the land, but they are doubly beholden to it. Not only is it the foundation and the scene of their habitation, but foodstuffs and raw materials for their clothing and shelter come from the nation's farm and ranch land.

Active attention to the care of your own plot of ground, no matter how small, may help to refresh your partnership with the nation's farmers and ranchers as stewards of the land.

And besides, it's the hard-headed practical way to protect your property values and create pleasant surroundings in which to live.

NJ–40420

Before your house was built, the rain fell evenly over the ground it stands on. Now your roof concentrates this water.

N–40427

Soil and Water Problems of Suburban Areas

Concentrations of people inevitably create problems of land use and protection. The natural landscape must be altered to make suitable conditions for people to live close together.

The natural regimen of soils and waters is upset when native cover is stripped away and replaced by roofs and paving. Runoff water behaves in new and sometimes violent ways when trapped in the rigid pattern of streets and gutters.

Under all is the land, and each householder is a land user.

CONN–10527

Increased Runoff

Suburban dwellers must cope with unnatural amounts and behavior of runoff water.

You see the results, for example, where the water pours off your roof into the flower bed. Before your house was built, the rain fell evenly over the ground it stands on. Most likely, a canopy of trees or mantle of grass kept the soil open and porous. Even in a hard rain, two-thirds or more of the water soaked into the ground as it fell. Now, it *all* comes pouring off the eaves.

This effect is multiplied by every house in your neighborhood, and by every school building and factory.

The paved driveway to your garage, the walk to your front door, the sidewalk and streets all seal off additional areas. The parking lot at your shopping center alone renders acres of land surface impervious to water.

Fully built-up areas are likely to be more than half covered with buildings and paving. The land between has had most of its original surface soil removed or covered with raw, earthy material in excavation and grading. The traffic of builders' equipment and human feet has further compacted the soil and deprived it of its original capacity to absorb water.

As a consequence, runoff from built-up areas may be 2 to 10 times as much as from the same land in farms or forest. Your first conservation problem, therefore, is to dispose of this excess runoff with the least damage to your own property or to that of your neighbors. You may also have the problem of protecting your property against runoff from land above it.

he buildings and parking
eas of suburban
opping centers
aterproof acres of land.

VA–W–2

Soil erodes wherever water hits bare earth. Here, erosio has ruined a carefully graded but unsodded slope.

Soil Erosion

Soil erosion makes many difficulties for the urban and suburban dweller.

The small size of your tract magnifies the seriousness of any loss of soil. You are rightly concerned over the appearance of a single gully or the caving of a bank.

Further reading: How to recognize erosion in the Northeast.

Most of the books and bulletins about soil and water conservation are written about agricultural land, but they will help you understand problems on your own land. If you read with your own conditions in mind, you will see many ways to apply the experience of farmers and ranchers to urban and suburban homesites. The principles of soil and water conservation are the same everywhere. Publications suggested for further reading on conservation are listed at the back of this pamphlet.

Soil erosion occurs wherever water—either rainfall or runoff—hits bare earth. A new house ordinarily has much bare ground around it. The first occupant has the job of establishing a lawn and covering the scars of construction. Even years later there may be some critical area—a shady spot, steep bank, or drainageway—where grass refuses to grow and each heavy rain cuts away the soil.

Areas actually covered by buildings or paving, of course, are generally safe from erosion. But the abnormal runoff from these impervious surfaces concentrates the erosion hazard on the soil areas between.

The cardinal principle of preventing erosion is to have the grounds as completely covered as possible with growing vegetation (grass, shrubs, etc.), or with some substitute cover like mulch, burlap, flagstones, or gravel. Areas that must carry concentrated runoff need to be permanently paved or protected by special turfs, riprap, or other means.

Floods and Sedimentation

Buildings and streets not only cause more of the rain to run off the land, but they also obstruct and concentrate its flow.

The straight lines of street gutters replace gentle meanders of natural drainageways. Those running cross-slope gather the increased runoff and detour it, not uncommonly through some householder's basement. Others leading downhill funnel the speeding water into the little valleys, inundating yards and buildings. Such layout is bad engineering, of course, but is all too common.

Any resident of a newly developed suburban area has seen the increased frequency of flooding in his neighborhood as building progressed. During the construction period, runoff water carries heavy loads of soil washed from exposed building sites. After landscaping is well completed, concentrated flows still are apt to cut exposed banks and scour stream channels. The sediment is deposited in many unwanted places—on lawns and in basements wherever floodwaters reach, in culverts, stream beds, and reservoirs.

Further reading: Sediment is your problem: wasted soil and water.

Although the damage you suffer from flooding and sedimentation may affect you individually, the cure usually requires community action. This problem is discussed in a later section.

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Neighborhood runoff floods streets and lawns. Below, sediment has ruined boating and fishing in a suburban lake.

How Soils Affect You

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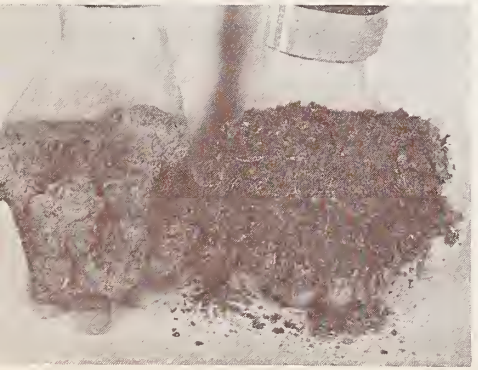

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Above, an unstable soil has slipped and swelled, causing the house to crack apart. Below, the crumbly soil on the right has room for air and water necessary to plants; the cloddy soil does not.

The possibilities and problems of your own piece of land are determined largely by the nature of its soils, its slope, and its position in the landscape.

As you settle down to the business of establishing a lawn and landscaping your grounds you may at times wish you had chosen some other spot for your suburban home. You come face to face with the realities of your soils when you try to spade a flower bed in stubborn clay, plant a tree in hard rock, or rebuild a terrace gutted by last night's rain.

But this is your plot of ground, and you want to make the best of it. After all, it is a small plot and you can do much to shape it to your wishes. The potentials are fixed by nature, perhaps, but you can make a good soil from a poor one if you wish. First of all you need to understand what you have to work with.

How Soils Differ

Natural soils differ in an almost infinite variety of ways. The scientific classification of the nation's soils recognizes thousands of individual kinds. Each is different from the others in depth, in size and arrangement of particles, in mineral composition, or in other important characteristics.

Most soils are made up of contrasting layers, called horizons, that have developed over the inert mineral material and bedrock from which they are formed. The kinds of soil are distinguished by the characteristic properties and arrangement of these horizons.

Published soil survey reports describe the soils of about a third of the total land area of the United States. If you are in a surveyed area, the report tells what soils occur in your neighborhood. Of course, on a small residential lot you need to verify the map by direct examination on the ground.

You may be able to find a copy of the soil survey report in the public library or obtain one from your county agricultural agent or Federal soil conservationist. These men can interpret soil information in relation to your individual problems.

Some suburban counties now employ their own soil specialists to identify soils and tell home owners, builders, planning officials, and others how soils affect urban development and land use.

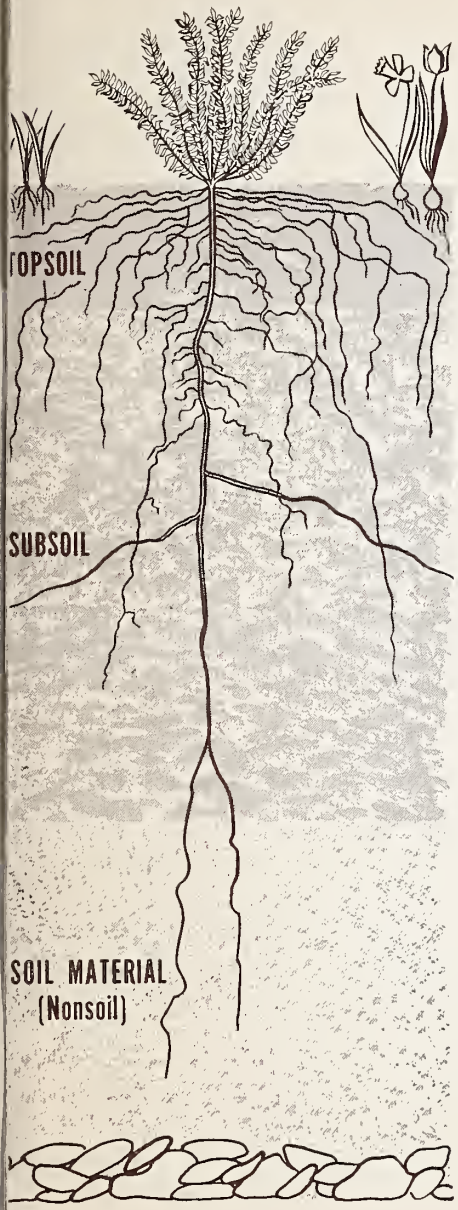
Some soils are easily worked and make stable footings for buildings; others settle, swell, or shrink and cause cracks in foundations and failures of walls and ceilings.

Some soils are deep and fertile; others are shallow and unfavorable for the growth of plants.

Some soils take in water easily and drain promptly; others are impervious or persistently waterlogged. Some readily absorb the effluent from septic tanks; others remain permanently wet and unsanitary when used for sewage disposal.

You need to be aware of these and other differences to understand your conservation problems and their solutions.

You need to know these things in advance if you are planning to buy a lot or build a house.



The ideal soil provides a deep working zone for roots.

The Ideal Soil

You may find that your soil is unlike any described for your area. It may have been greatly altered in building your house. The original surface layer may have been removed in grading the lot, or it may have been covered by inert material from excavations. In spots it may be filled with rocks and debris left by the builders. The zone against the sides of the house—just where you want to put flower beds—is especially likely to be filled with worthless trash if a bulldozer was used to excavate the basement.

Whether your soil is a natural or a modified one, it may be far from ideal for growing grass, flowers, and vegetables. In fact, you may want different kinds of soil for different areas, depending on how you plan to use them. Play areas, for example, need different turfs from lawns. You want to keep water *out* of soils under playgrounds, driveways, and pavements, but you want it to soak *into* flower beds and vegetable gardens.

You can do much to change soil to your needs. Farmers regularly improve their soils by tillage and cropping methods, and you can afford to put even more effort into a small garden spot. If nothing else will suffice, you can remove the troublesome material and replace it with good soil.

As a goal toward which to work, here is a description of the "ideal soil" for plant growth:

1. The Ideal Soil has a deep rooting zone from which plants can take both water and nutrients. This zone is at least 18 inches deep; most plants do better if it is thicker, even 4 to 6 feet. A shallow soil cannot hold enough water and nutrients to keep plants growing at their best.

2. The Ideal Soil is loamy in texture; that is, it consists of a favorable mixture of sand, silt, and clay particles. Sands take in water readily but retain only a small part of it. Clays hold a great deal of water, but unless handled carefully they tend to become hard and massive when dry.

3. The Ideal Soil has good structure. The particles of sand, silt, and clay are grouped into granules or crumbs, permitting water to enter easily, roots to penetrate deeply, and air to move in and out freely. The surface is moderately cloddy, not fine and dusty. The soil is firm enough to hold moisture and make close contact with seeds and roots. It allows excess water to drain through promptly but holds a good supply for plants to use between rains and irrigations.

4. The Ideal Soil contains much organic matter in various stages of decomposition. It also contains many micro-organisms and small animals, such as earthworms, that help decompose the organic matter. In the process they release nutrients for use by new plants. The partially decomposed materials that make up "humus"

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The best way to know your soil is to dig a hole and look at it.

produce stable granular structure in the soil. Since the organic matter in the soil is constantly being broken down, new supplies must be added regularly to maintain life in the soil.

5. The Ideal Soil has an adequate and balanced supply of nutrients for the plants to be grown. Most vegetables do best in soil of high fertility and most flowers in soil of moderate fertility. The herbs and some flowers and shrubs prefer low fertility.

6. The Ideal Soil has proper reaction (acidity) for the plants to be grown. Roses, most annual flowers and vegetables, and most lawn grasses should have a slightly acid to neutral soil. Some plants, like azaleas and rhododendrons, require an acid soil.

Further reading: Soil: the 1957 yearbook of agriculture *contains many helpful articles, especially "Home gardens and lawns," p. 665. Also see* Your soil—crumbly or cloddy?

See for Yourself

Whether or not you find a soil survey report for your area, you will need to examine your own soils to be sure what they are. The scale of soil maps is necessarily too general to identify soils with certainty for areas as small as most suburban residential tracts. Also, unrecorded local deviations may be important in your lawn or garden.

You can make your own study by systematic borings spaced to sample every part of your tract. More likely, you will prefer to make your observations incidentally to other work on your grounds.

As you dig holes to set posts, plant trees, or make flower beds, you can note the soil layers exposed. Be sure to dig deep enough in each case to see the full depth of the normal rooting zone—at least 3 feet or to hard rock. As time goes on you may need to dig a few special holes to complete the picture for parts of your tract missed in the course of other work.

You do not have to be a soils expert to make useful observations about your soil. You can see how deep it is and get a mental picture of the different layers that will help you understand how plant roots are apt to behave in it. You become aware of differences between parts of your tract that help explain variations in plant growth, behavior of runoff water, and other matters.

Here are some of the things to look for:

Depth.—Take separate note of the thickness of each recognizable layer, as well as the total depth to which roots can penetrate. The deeper the effective rooting zone, the greater its capacity for storing moisture and making nutrients available.

Texture.—Note the coarseness or fineness of the material in each layer. *Sand* grains are large enough to be seen and felt individually. *Silt* particles are medium-sized, like flour or chalk dust. *Clay* particles are microscopically fine and when wet can be molded into plastic forms. A mixture of all three sizes is called a *loam.* You can get a rough idea of the proportions of sand, silt, and clay by putting a sample of soil in a jar of water, shaking vigorously for 2 or 3 minutes, then letting it settle into layers. The sand particles will drop to the bottom almost immediately, silt within a minute or so, and the clays later.

Structure.—Note whether the soil is loose and crumbly or hard and massive. The structure or "tilth" of the soil is a result of the degree to which the individual particles group themselves into larger units, or "aggregates."

Permeability.—An important property of a soil is how rapidly water and air move through it, called permeability. You can form some opinion of permeability by noting how loose and open or tight and compacted the different layers are. Or you can pour water on dry soil and dig a few minutes later to see how deep it has penetrated. Before planting a shrub or tree in a prepared hole, you can fill it with water and see how quickly it goes away.

For a more accurate test, cut the bottom from a coffee can and push the open cylinder into the soil surface. Fill the can with water to some mark near the top, and observe how rapidly it soaks into the soil. You may come back in an hour or half hour and measure how far the water in the can is below the original mark. If, after the soil is thoroughly wet, the water level goes down 3 inches or more per hour, the permeability of the soil is considered to be *rapid,* 1 to 3 inches per hour *medium,* and less than 1 inch per hour *slow.*

Drainage.—Note whether water remains in the soil for a long time after wetting or drains away promptly. Locate any permanently wet areas, seepage zones, or high water tables.

Fertility.—Have soil tests made of samples from your garden, flower beds, and lawn—espe-

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A soil sample shaken in water separates into layers of sand, silt, and clay. Below, a test with a bottomless can shows how rapidly water enters the soil.

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If your land is sloping you may want to make a contour map.

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cially from problem areas. Call your county agricultural agent or write your state agricultural college for instructions for taking and mailing the samples. The reports will include recommendations of fertilizers to suit the conditions shown by the tests. There may be a small charge for these tests.

Topography.—You also need a clear picture of the slopes and topography (surface configuration) of your land. You can buy or borrow a simple hand level with which to measure the principal slopes and determine the high and low points.

If you know how to use a surveying level and rod, or can enlist the help of a friend who does, you may find it worth while to make a simple contour map of your grounds.

For a small tract of 5 acres or less it is usually sufficient to locate a single bench mark and determine relative elevations at points 25, 50, or 100 feet apart around the boundaries of your plot. Choose as the bench mark a point on a permanent and stable structure, such as a manhole cover or corner post, that can be seen from as much of your area as possible. On a map drawn to scale, plot the elevations of the stations around the boundary, of high and low points within the property, and of other points of interest. With these fixed points as guides, you can sketch in rough contour lines at 1-, 2-, or 5-foot vertical intervals, whichever is practical for the size and steepness of your tract.

Now sketch in the courses of any drainageways that cross your property. Look around you and see how your land lies with respect to the surrounding landscape. Is it at the top of a hill so that water runs only away from it, on a slope where water drains onto it from above and off onto land below, or in a valley where it receives run-in from several directions? Mark the points at which surface water enters and leaves your property and the routes of flow across it.

With this information you are ready to make realistic plans for soil and water conservation on your land.

A soil auger can help you find out what kind of soil you have.

N—2647

A Plan To Guide You

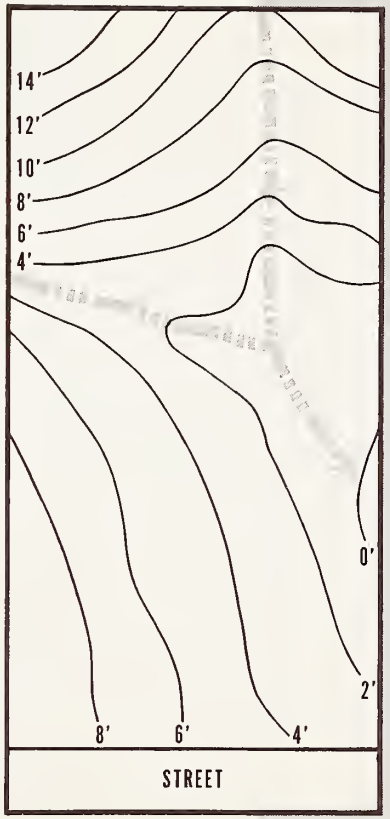
Land care is a continuing long-term affair. Every conservationist keeps the future in mind as he works with his land from day to day, for concern for the future is the essence of conservation.

To improve your home surroundings, you need a mental image of how you want them finally to be. You need to have in mind where each soil and water problem is, what causes it, and what you intend to do to correct it. This mental picture of your land conditions and goals is a conservation plan, whether you carry it in your head or have it recorded on paper.

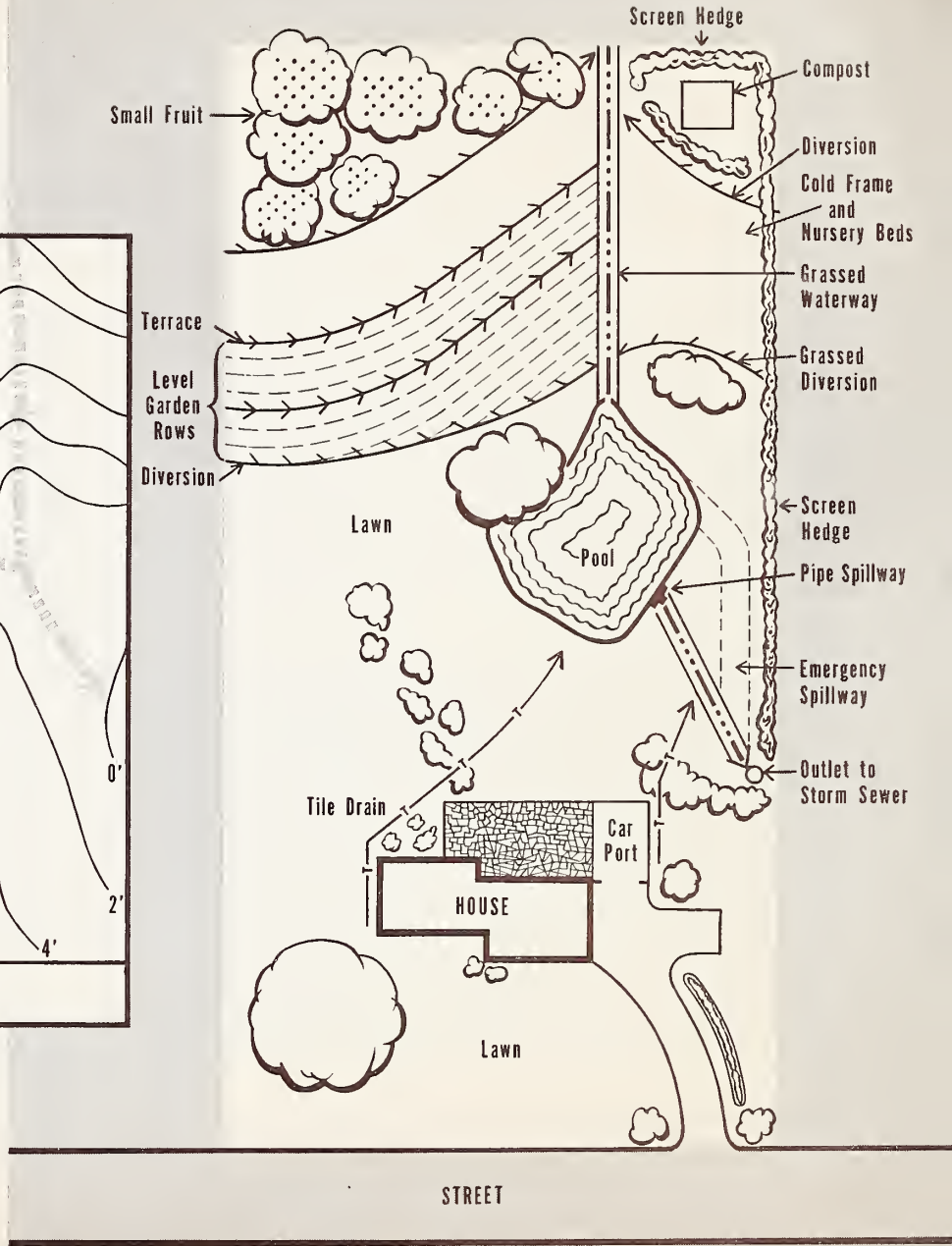
Farmers and ranchers who are serious conservationists usually have complete conservation plans for their holdings, worked out with the aid of conservation technicians. A plan is equally important to the solution of conservation problems on an urban lot or suburban tract.

Even for a small level city lot, you may have need for written plans or maps. You will need to decide where you wish to plant trees and

A suburban-homesite landscaping plan that includes conservation practices.



A contour map of the homesite.



shrubs, where you will have flower beds and vegetable garden, if any. You will need to fix the courses of walks and roads.

Landscape experts make planting plans for even the smallest jobs. With information about your soils and topography, you can make your landscaping plan fit the land and help solve soil and water problems. A detailed plan drawn to scale on graph paper will help avoid costly mistakes.

Troublesome concentrations of runoff or peculiar soil areas will help decide the layout of your grounds. Or, to put it another way, you can make the pattern of your plantings and structures either cure or aggravate unfavorable soil and water conditions. You may want to discuss these matters with your landscaping man, if you have one; he may be able to make major erosion-control, drainage, and flood-protection measures a basic part of your design.

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Suburbanite reseeds part of lawn washed out by rainwater gushing from roof spout.

Suburban contour garden grows strawberries, onions, lettuce, spinach, and peas.

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On the larger tract or where you must contend with large amounts of runoff, you will need to pay special attention to how water will be conducted across your property. In locating diversions, terraces, waterways, drainage ditches, or tile lines, you need to consider the lay of the land as a whole, including neighboring tracts that affect your own or are affected by it.

If you plan to have a pond or other complicated structures you will need to develop, or obtain from experts, designs and specifications to guide construction. You may also get fertilizer and seeding recommendations prepared especially for your conditions.

All these things taken together are your conservation plan. Like the conservation plan of a farmer or rancher, it is the blueprint to the use, care, and improvement of your land. It enables you to move consistently toward your goal as you go about daily work on your home grounds.

Practices for Residential Tracts

Water Control

Concentrated running water causes most of the severe erosion on residential tracts. Your first concern is to control the abnormal runoff from buildings, paving, and compacted earth and guide it to a safe disposal outside your boundaries.

You can keep running water from cutting up your grounds by (a) keeping it spread out and moving slowly enough that it does not scour the soil, (b) diverting it away from areas it could damage, or (c) making it flow on erosion-resistant surfaces, like dense sod or concrete.

Your topographic map, if you have one, will show where to expect concentrated flows of water. A pattern of safe drainageways is the framework of a successful conservation plan.

Layout of grounds.—If you have room for some freedom in the arrangement of your buildings and grounds, you can reduce runoff problems by locating driveways, walks, and yard and garden edges to follow level contours and gentle slopes. Lines that lead water directly downhill give it maximum speed and cutting power. Cross-slope designs are better than up-and-down-hill ones. On small lots complicated contour patterns are not necessary; straight lines across the slope are satisfactory.

Grading.—On small areas you can afford to reshape the ground surface by grading. Plan cuts and fills to give a maximum area of gentle slopes and to dispose of runoff water safely. Wide bench terraces with the intervening banks protected by vegetation or retaining walls are often the most practical treatment for steep slopes around buildings. Good topsoil should be removed and stockpiled before excavating or grading so it can be replaced on the final surface.

Diversions.—You can use a diversion to turn water away from a critical area or lead it to a pond or drainageway. If runoff from sloping land above your property causes damage, you can either divert it away from the trouble spot or prepare a waterway to lead it safely through your property.

A diversion is a ridge with a channel above it, following the approximate contour to a safe outlet. It is usually kept covered with turf to prevent erosion.

For all but the smallest diversions you need

Miniature diversion (ridge) guides water away from a sloping part of the yard.

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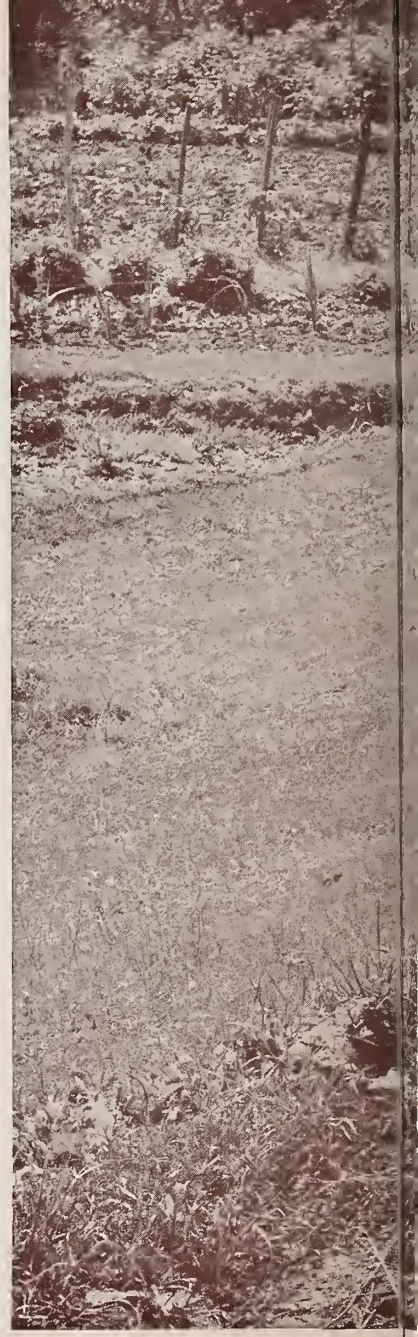

A grassed waterway provides a channel for water to flow through the garden without carrying away soil.

correct specifications to fit each situation. The height of the ridge and size of the channel must be adequate to carry the amount of water coming from the drainage area, and the "grade" or slope along the channel must be correct to keep the water moving steadily, so it will not pile up and overtop the ridge. You may need to get technical help to design a diversion.

Before making any major change in the natural course of runoff, check the legal requirements with local authorities; you may need to obtain easements or make other arrangements with affected property owners.

Further reading: Soil: the 1957 yearbook of agriculture, *p. 301.*

Waterways.—If you have a concentration of water at any point, you need a waterway to carry it to a stream or other safe disposal. The little draws and valleys in the landscape are natural waterways. When they are forced to carry increased amounts of water because of the abnormal runoff from built-up areas, their channels are likely to be scoured into gullies. You can protect such a natural waterway by shaping and smoothing the bottom and establishing a dense sod on it.

If it is needed, you can create an artificial waterway by shaping a wide-bottomed ditch down the slope and sodding it. In some situations it may be more practical to line a small ditch with concrete or use a tile or pipe line.

Waterways, like diversions, need to be designed to carry the amount of water they will receive.

Further reading: Grass waterways in soil conservation; Soil: the 1957 yearbook of agriculture, *p. 293.*

Drainage.—If you have a wet basement, seepy spots, or waterlogged soils, you may need to install tile lines or other means of draining them. Some knowledge of soils and engineering is necessary to analyze most drainage problems. Such technical help could save you much effort in trial-and-error attempts.

You can usually drain a house site by laying a line of fiber pipe or tile around the foundation a few inches below the level of the basement floor. Every drain must have a suitable outlet or a sump pump to remove the excess water.

The practice of "bedding" makes it possible to grow plants successfully on many soils that naturally drain slowly. In bedding, you shape the surface of the soil into broad parallel ridges separated by furrows to lead excess water away. The plants grow in the well-drained soil of the ridges.

WV–155–8

Lawns and Yards

After your grounds have been laid out and graded to minimize and control runoff, the next essential of soil conservation is to put a permanent cover on all areas that will not be cultivated annually. Grass, trees, shrubs, or vines will protect the soil from splashing raindrops and scouring runoff.

Well-maintained lawns and ornamental plantings not only beautify home grounds but are the most practical of erosion-control measures.

Lawn grasses.—The kinds of grasses and methods of planting and care that succeed best in your locality can be learned from neighbors or from landscaping or agricultural specialists. They vary so greatly from place to place that details cannot be given here.

Poor soil conditions account for many lawn failures. If you have trouble spots, you may be able to find the reasons by studying your soil, as suggested on page 8. Sometimes the most practical solution for a small problem area is to remove a foot or so of poor soil and replace it with better.

Too-close mowing is a frequent cause of failing lawns. Grasses, like other plants, must produce their own food in their green leaves; if the

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Lawns, trees, and plants not only beautify home grounds but are also the most practical of erosion-control measures.

leaf surface is too greatly reduced, they starve. Also, close clipping permits the sun to strike the crowns of the plants. In cool regions, clip grass no closer than 1 inch; in warm areas 1½ to 2 inches is better.

Regular and frequent mowing at the correct height returns a steady supply of needed organic material to the soil. Heavy clippings from infrequent mowings, however, may smother grass. They should be removed to the compost pile.

Further reading: Better lawns. *Also write your State college for its bulletin on lawns.*

CONN-10263

Other ground covers.—Grass is not the only type of plant that makes good ground cover. Vines and creeping plants can be used with good results on cut banks and on steep slopes where mowing is impractical. Some, like periwinkle (*Vinca*) and English ivy (*Hedera*), will grow in dense shade where grass does not thrive.

These plants add pleasing variety to the scene. Local authorities can recommend species adapted to your conditions.

Windbreaks and hedges.—Windbreaks and hedges add to the comfort and beauty of home grounds. They give protection from cold winds and create more comfortable working conditions outdoors. They protect delicate plants from wind damage and reduce evaporation and soil blowing.

Windbreaks and hedges also give privacy to home grounds. They attract birds and other wildlife by supplying food, nesting places, and shelter.

Coniferous trees and evergreen shrubs give the most protection in windbreaks. Certain dense-growing shrubs, such as privet (*Ligustrum*), box-

A suburban pond (left) can be a recreational area as well as an emergency supply of water. Kudzu (right) and other vines can protect streetside banks that are too steep for grass.

MISS–W–1

wood (*Buxus*), and yew (*Taxus*) make good hedges. Inquire locally about the best species to use.

Further reading: Windbreaks in conservation farming.

Landscaping for wildlife.—Birds, squirrels, and other forms of wildlife are among the principal attractions of suburban living for many people. You can assure them a prominent place in your surroundings by using plants that produce favored foods or superior cover.

Birds, especially, can be attracted by fruit-bearing shrubs and trees and by grains and sunflowers. The trees and shrubs used in windbreaks and hedges are among the best to provide nesting cover and winter shelter. Oaks and nut trees, of course, attract squirrels.

Conservation and landscaping authorities can suggest locally adapted species that are especially beneficial to wildlife. If a majority of the people in a neighborhood give emphasis to landscaping for wildlife they can enjoy an abundance of birds and small mammals seldom matched in the open country.

Further reading: Making land produce useful wildlife; Songbirds in your garden.

Ponds.—A pond can be a useful and attractive feature of a suburban home. It can provide opportunities for swimming, boating, and fishing, and can supply water for fire fighting, irrigation, and for emergency domestic use.

A simple "dugout" pool can be excavated on any site that has suitable soil material and that is protected from flood waters. Soil that will not hold water can be sealed with materials available commercially.

A larger pond formed by damming a little watercourse needs to be carefully designed to fit the site. Its size must be in correct proportion to its watershed, and it must have a spillway of proper size to handle the expected runoff. This is a job for someone with engineering knowledge. In some states it is necessary to get a permit to build a pond exceeding a certain size.

Safety must be carefully considered for ponds in suburban areas. In some states, ponds are regarded as "attractive nuisances" for children, and the owner may be held responsible for accidents occurring in them. You will want to take precautions to keep unsupervised children away and to warn adults of dangers. Remove hazards, such as submerged stumps and trash, and provide ring buoys, ropes, and other life-saving devices at swimming areas.

Further reading: How to build a farm pond; Make your farm pond safe: prevent drownings.

Hedges and windbreaks with fruit-bearing shrubs and trees attract wildlife.

MONT–169

Vegetable and Flower Gardens

WV-804 *Contour rows curving around the slope reduce runoff and erosion in the garden.*

Vegetable and flower gardens need special conservation measures because the soil must be laid bare and cultivated each year. They correspond to the croplands of farms, and many of the same practices that farmers use can be adapted to the smaller cultivated areas of residential tracts.

Contouring.—Straight lines and rectangular plots do not fit well on curving slopes. Gardens and flower beds laid out "on the contour" are both practical and pleasing to the eye.

Miniature terraces (ridges) divide this slope into short segments. The terraces intercept the runoff and cause it to flow away slowly.

MISS-D14-8

Rows that follow level lines across the slope, rather than up and down hill, help control runoff and reduce erosion. The ridges and furrows left by tillage serve to hold back the water. On moderate slopes, contouring of croplands reduces erosion by as much as half.

On curving or irregular slopes you need a surveyed line as a guide for contour rows. With someone to help you, you can use a hand level to find points of equal elevation, or you can use a carpenter's level on a home-made frame. A simple procedure for small areas follows:

First, find the point on your helper's body that is level with your eyes (e.g., hair, face, or shoulder). Then, when your line of sight through the level strikes that point, you are both standing at the same elevation.

Next, decide where the key contour line should be, preferably about midway of the prevalent slope. Set a stake and stand by it while your helper walks about 50 feet (or not so far on sharp curves) around the slope as nearly on the level as he can. When he stops, sight through the level and signal for him to move up or down the hill as necessary until your line of sight strikes the part of his body previously determined. When you signal that he is on the level with you, he drives a stake.

Move to the new stake while your helper moves on, and repeat the process. When you have crossed the plot in this manner, you will have a line of stakes all on the same level. The line can now be marked with a hoe or plow. Other

guide lines as needed can be measured off to parallel this key line.

In small gardens with regular slopes where rows are less than 100 feet long, straight lines across the slope are near enough the contour for practical results.

Further reading: Soil: the 1957 yearbook of agriculture, *p. 293.*

Terraces.—If the slope is so steep that water commonly overtops the ridges left by tillage, you need terraces at intervals to intercept the runoff. Terraces are like small diversions through cultivated land, so spaced that each ridge can handle the runoff water from the interval above without being protected by permanent sod.

On fields large enough for the use of regular farm machinery, terraces need to be laid out according to engineering specifications to fit the soil and slope. On small garden plots you can use miniature terraces following contour lines at intervals of 25 to 50 feet. A channel 3 to 6 feet wide with a depth of 1 foot below the top of the ridge is usually sufficient. The ridge needs to be reinforced by heavy fills across gullies or depressions. Through trial and error you will find the size that will withstand normal runoff for your plot.

You need a safe place to dispose of the concentrated flow of water from terraces. If each terrace does not empty onto sod or a stable drainageway, you will probably need to prepare a grassed waterway as described on page 14. Needed waterways should be completed before you build the terraces.

Further reading: Soil: the 1957 yearbook of agriculture, *p. 297.*

Cover crops.—Where you cannot keep the soil permanently covered, the next-best erosion-control measure is to grow temporary "cover" crops between seasons or between the rows of your main products. You can, for example, sow small grain or some other adapted crop in the fall to provide a soil cover for your garden plot during the winter. You can use the same crops between fruit trees or berry vines.

ORE–75060

In this cherry orchard, a cover crop slows down runoff and erosion.

A dense crop planted in a contour strip alternates with corn in a small suburban field. The evergreens in the background form a windbreak.

A satisfactory cover crop must grow quickly, cover the ground completely, and be easily turned under or removed to make way for the main crop to follow. The material turned under also serves to improve soil structure and fertility.

The following are commonly used as cover crops: rye, wheat, barley, oats, ryegrass, turnips, mustard, rape, vetch, and various clovers. Agriculturists can suggest varieties best suited to local conditions.

Further reading: Soil: the 1957 yearbook of agriculture, *p. 252.*

Stripcropping.—On fields and large garden plots you can get some of the benefits of cover crops during the main growing season by planting them in strips alternating with parallel strips of clean-tilled crops. The cover strips not only protect the areas they occupy, but they slow down runoff water leaving the clean-tilled strips. They make it easy to walk around through a garden when the soil is wet.

The strips should be laid out across the slope, preferably on the true contour. Stripcropping and contour tillage together may reduce erosion as much as three-fourths on moderate slopes and one-half on steep ones.

The location of the cover strips should be shifted each year to give the entire area the benefit of the soil-improving crops in rotation.

Further reading: Stripcropping for conservation and production; Soil: the 1957 yearbook of agriculture, *p. 295.*

Residues and mulches.—Dead cover is just as effective as living plants for protecting soil from erosion. You can leave the dead plants and residues of crops and weeds on the soil surface, if disease, insect, and weed hazards will not be too greatly increased by doing so. Chopping or shredding the material increases its effectiveness by making it cover the ground more thoroughly and decay more rapidly. This practice, called stubble-mulching, is most applicable to farm-size fields.

Where it is not practical to use the crop aftermath itself as a mulch, you can bring in straw, hay, tree leaves, wood chips, wood shavings, sawdust, or other materials for this purpose. This is usually more satisfactory for small gardens and flower beds.

Besides preventing erosion and conserving soil moisture, a deep mulch suppresses weeds. To control weeds you need at least a foot of hay, straw, or leaves, or 5 inches of wood chips or shavings, in the loose condition. Either will settle to a depth of 2 or 3 inches.

Further reading: Wood chips for the land; Soil: the 1957 yearbook of agriculture, *p. 675.*

Unless your soil is unusually fertile, you will need to apply nitrogen fertilizer with the mulch to prevent temporary nitrogen starvation of the growing crop.

Compost.—Organic matter is vital for sustaining life in the soil and keeping its structure favorable for plant growth. A soil with high organic content is also likely to resist erosion and take in water more readily than a depleted one.

Soil needs a continuous supply of new organic matter to replace that used up by organisms. Many gardeners use compost as a means of replacing organic matter.

By composting you can convert almost any kind of organic waste—leaves, lawn clippings, hedge trimmings, weeds, garden plants, garbage, etc.—into organic matter approximately like that in fertile soil. You can use this material directly in your flower beds and gardens as a combination fertilizer and mulch.

Almost any garden book will give you detailed instructions for making compost.

Further reading: Soil: the 1957 yearbook of agriculture, *p. 237, 245, and 673.*

Lime and fertilizers.—Plants must have a balanced supply of nutrients and a proper degree of acidity for normal growth. These conditions seldom occur naturally in soils of urban and suburban areas. Correctly used, lime and fertilizers can help you create something approaching the "ideal" soil for your plants.

You can usually get specific recommendations of the kinds and amounts of fertilizers to use for particular kinds of plants by asking for this information when you send soil samples for analysis, as suggested on page 10.

Further reading: Soil: the 1957 yearbook of agriculture, *p. 676;* How much fertilizer shall I use?

A mulch in the garden covers the soil and suppresses weeds. Dead cover is just as effective as living plants for protecting soil against erosion.

WV–828

A compost heap converts leaves into a valuable soil-conditioner. Almost any kind of organic waste can be used.

MASS–182

N-40432

The danger of erosion is greatest during the period of construction. This soil has been stripped of its natural protection.

Practices for Construction Sites

The period of construction is the critical time for erosion in suburban areas. If you build your own house you will have the immediate problem of controlling erosion and runoff from your site.

Contractors and builders are often under severe pressure to prevent damage by runoff and sediment originating on their grounds. Some cities and counties have regulations aimed at minimizing erosion of construction sites.

The period of greatest erosion hazard usually lasts from 3 months to a year for an individual home site. Large housing developments and major construction jobs may keep the disturbed area bare and vulnerable from 1 to 3 years.

Here are some of the things that builders can do to reduce damage:

Keep the site covered.—Any disturbance of ground cover and soil will give opportunity for erosion. Vegetation of any kind should be left until immediately before construction and restored immediately after. Only the minimum area required for operations should be disturbed at one time.

When extended periods of exposure are unavoidable, temporary cover should be provided. Annual grasses, small grains, or sod will make a quick cover. Mulch, burlap, plastic, tarps, and other materials can be used where vegetation cannot be established promptly.

If selected trees can be left, several years of time will be gained in landscaping later. They can be protected from injury by bulldozers or other heavy equipment working on the lot by encasing them with heavy planks tied vertically around the trunks. Large trees are killed also by deep fills of dirt around them. If the site is to be covered with more than a foot of new earth, the builder should provide aeration for the root zone by placing a gravel layer beneath the fill with openings to the surface.

Control velocity of runoff.—Unavoidable storm runoff can be directed to safe drainageways at

velocities of flow that will not scour and transport soil.

Contour diversions can be used to collect runoff, concentrate it into channels, and lead it by means of meanders or drop structures to safe outlets. Extensive systems need to be designed by an engineer.

Curbs of dirt, timber, or other material can be placed at the crests of steep fills or cuts to divert runoff from unprotected slopes. The water can be released to lower levels by paved chutes, pipes, or timber flumes.

Larger drainageways can be temporarily stabilized by dams of brush, logs, sod, rocks, or other materials.

Trap sediment.—Some erosion is inevitable during periods of active disturbance of the construction site. Dams or basins to trap the sediment and hold it on the property reduce damages downstream. If the basins are small it may be necessary to empty them of sediment after major storms.

Technical knowledge is needed to design extensive protective measures. Advice can usually be obtained from the county engineer or agricultural agent, the Federal soil conservationist, or from professional engineering or landscaping consultants.

Dams and basins can be built to trap sediment on construction sites.

N–40426

ILL—2070

A natural area preserved on a school ground provides an outdoor laboratory for teaching science and conservation

Practices for Streets and Parks

Public grounds need the same kind of protection as private yards and lawns, with diversions and waterways to control runoff, and vegetation to prevent erosion. In addition, streets and parks often present special problems not often found on small residential tracts.

Streets and roads.—Good planning of the layout of areas for development can minimize runoff and erosion problems by taking into account the "lay of the land." Streets and roads that follow general contours and moderate slopes offer less obstruction to natural drainage and are easier to stabilize and maintain than those set in a rectangular grid pattern.

Information about soils and watershed characteristics, usually available from the Soil Conservation Service or planning officials, can help in fitting suburban developments to the landscape.

Unpaved road ditches and street gutters need to be shaped and sodded to serve as grassed waterways (p. 14). Those running down steep hills may need the additional protection of check dams, flumes, or other devices. Cut banks and fills need to be sloped to a moderate angle and covered with perennial vegetation for permanent cover.

School grounds and parks.—Wise choice of sites and good planning of layout can avoid many of the erosion and flooding problems that commonly plague school grounds and parks. Soil maps and other information available in many areas from the Soil Conservation Service can be useful in planning new grounds.

On existing grounds, shrubs can be planted to direct people away from areas denuded by heavy trampling. Diversions and waterways can be used to control the flow of water. Grasses and vines can be planted to cover eroding soils.

Like any private home site, a school ground or park needs a conservation plan fitting together all the practices required by its peculiar soil and topographic conditions. (See p. 11.)

School grounds and parks offer an opportunity to preserve small natural areas for study and en-

Cut banks along streets and roads can be stabilized with a sod of grass.

N–40435

joyment by the community. Sites can be selected and buildings located to protect choice tracts of woodland, grassland, marsh, rock outcrops, and other natural features of special interest. Such areas are needed for outdoor laboratories in teaching science and resource conservation. In large cities youth organizations such as Boy Scouts and Girl Scouts must depend on such areas for most of their outdoor projects.

Further reading: Conservation of the camp site; Manual for outdoor laboratories.

Stabilizing streambanks.—Streams through parks and residential areas are usually subject to bank erosion because of the increased runoff from built-up watersheds. Culverts and other structures often obstruct or concentrate the flow of water; so do logs and other debris that are allowed to accumulate in channels.

The removal (often unnecessary) of vegetation from streambanks in preparation for construction makes them vulnerable to the scouring action of high waters. In parks the clearing of underbrush and concentration of people in recreation areas may denude streambanks and lead to erosion.

The first step in correcting streambank erosion is to remove as much as possible of the cause. Be sure that bridges and culverts are large enough to pass high water without creating turbulence. Remove obstructions from channels and see that drainage ditches enter the main stream without directing strong currents against the banks.

In highly developed areas it may be necessary to enlarge or straighten a channel to enable it to carry the increased runoff. Successful alteration of natural channels is a delicate operation that requires careful engineering planning and supervision.

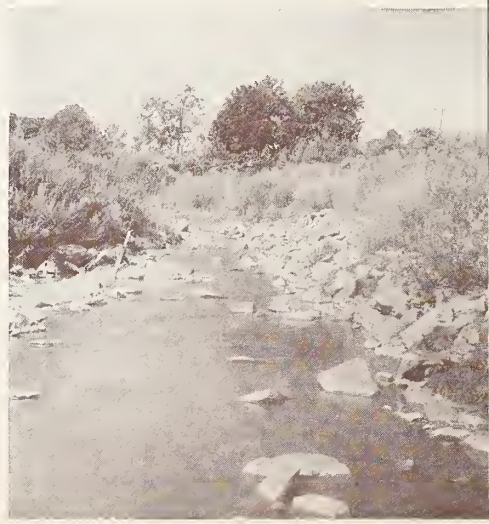
Eroding sections of small streams with banks less than 10 feet high and watersheds of less than 10 square miles can often be stabilized by sloping the bank and protecting it with brush mats, willow poles, riprap, or other devices until permanent vegetation can be established. Brush-type willows are among the best plants for this purpose. Local soil conservation and landscaping authorities can give detailed instructions for this work.

Stabilizing the banks of larger streams is a job for experienced technicians.

Landscaping for wildlife.—Parks, streetsides, and other public grounds offer opportunity for creating attractive habitat for wildlife on an extensive scale.

The use of fruit-bearing trees and shrubs, nut trees, grain patches, and dense thorny shrubs in the initial landscaping, as suggested for private grounds (p. 17), will do much to enliven residential neighborhoods with an abundance of interesting wildlife.

The banks of this stream have been stabilized by stone riprap on the right and basket willows on both sides.



NY–942

Protecting Suburban Watersheds

Many of the erosion and flood problems that plague urban and suburban residents can best be solved on a group of adjoining properties rather than on each separate lot. Some can be solved in no other way.

Farmers have found the "watershed" approach the practical way to control runoff water. The same principles apply in suburban areas, because runoff is governed by watershed boundaries and drainage patterns, not by property lines.

Study your watershed.—An interesting project for a Sunday afternoon is to try to find the boundaries of your watershed.

If you have any problem of runoff water crossing your land or flooding from a nearby stream, this search may lead you to its origin.

What is a watershed? It is all the area from which water drains to a particular point of interest. One slope of your roof is the watershed of the gutter that catches its runoff. A rill through your garden may receive water from a fraction of an acre; that area is the watershed of the rill. The depression into which the rill empties may drain water from an entire city block or several acres; this is a still larger watershed of which the rill's watershed is a part. Each larger drainageway has a successively larger watershed embracing the separate watersheds of all its tributaries. Thus, the stream that runs past your property may have a watershed of several city blocks or even several square miles.

You are concerned with the particular watershed that contributes to your problem. You want to answer the question: Where does this water come from?

The watershed boundary is the ridge line or barrier that divides the water that runs to your point of interest from the water that does not. Streets, drainage ditches, and other structures change drainage patterns in built-up areas. They may divert water away, or they may bring additional water to your point of interest. You must consider these man-made changes in defining your watershed. It will be helpful to compare the present modified watershed with its original natural boundaries and drainageways.

You may be able to interest a neighbor in helping to locate the boundaries of a larger watershed that affects mutual flooding and sedimentation problems. Then, together, you can seek out the critical areas in it that contribute large amounts of flood water and eroded material. You will look for denuded construction sites, bare cuts and fills, straight-row cultivation of clean-tilled crops, eroding road ditches and streambanks, and other problem sites described in the foregoing pages.

Talks with the owners of critical areas may lead them to correct harmful conditions. If not, you are at least better prepared to base your own defensive measures on a realistic knowledge of the nature and scope of the problem.

Neighbors working together.—The larger watershed problems, such as floods in the valleys and sedimentation of reservoirs, usually can be dealt with only by cooperative action of the land holders in the watershed area. The more difficult situa-

tions may require major structural works, such as floodwater retarding dams, diversions, drainage ditches, sediment basins, or extensive planting or mulching of eroding areas.

Sometimes these measures are needed on public land or need to be larger than individual landowners can provide at their own expense. Then some kind of public action—as by city, county, or special district authorities—is needed.

Neighbors with a common interest in such problems often organize into civic improvement associations to initiate needed action. Such groups can bring pressure on negligent land owners or builders to correct conditions under their control. They can bring problems to the attention of public officials and encourage enforcement of regulations; they can support public expenditures for needed improvements.

In watersheds that include agricultural as well as urban land, Federal assistance for flood prevention, erosion control, and water management measures may be available under the Watershed Protection and Flood Prevention Act. The local or State office of the Soil Conservation Service can give you information about small watershed projects under this act.

Such projects, where applicable, offer opportunity for urban and rural people to work together to deal effectively with mutual water problems.

Further reading: What is a watershed?; Small watershed projects under the Watershed Protection and Flood Prevention Act.

A floodwater-retarding dam and conservation practices on the watershed protect the town downstream. When the stream rises against the dam, the table-shaped drop inlet receives the water, passes it slowly into a pipe running under the dam, and empties it into the stream on the other side.

WV–837 A

CONN–10262

A soil conservationist with a soil map can help community planners find a practical pattern of land use.

Community Planning and Zoning

A community needs a well-thought-out plan for the development and use of its land and water resources, just as an individual home owner or farmer does. Many of the difficulties in controlling runoff and preventing erosion, as well as other problems associated with "urban sprawl," arise from the way adjoining tracts of land are used.

Such problems are more easily prevented than cured. A community land use plan suggests how private and public improvements and land uses should be related to each other.

Many cities and counties are giving serious consideration to the future development of suburban and adjoining rural areas. Some of the more advanced are making their plans binding through zoning regulations.

A good many public agencies and organizations stand ready to help local planning authorities with the complex problems they face. Citizens' groups can help by participating in hearings and by taking active part in the discussion and selection of alternative proposals.

Any community land use plan needs to be based on a thorough inventory of community resources. The Soil Conservation Service can usually help by providing soil surveys and interpreting the information in relation to problems of crop production and plant growth, building construction, water control, sewage disposal, and other matters important in suburban development.

The land capability classification based on soil surveys is a useful guide to locating highways and intensive construction so as to reserve the most productive land for agriculture and keep a reasonable amount of open space in residential areas.

Where small watershed projects are appropriate to urban fringe areas, the Soil Conservation Service can also provide technical assistance in analyzing watershed conditions and developing project plans. Many kinds of specialized information are available from other State and Federal sources.

Further reading: Zoning for rural areas; Land: the 1958 yearbook of agriculture, *p. 524.*

For Further Reading

There are many good books on landscaping and gardening but few that deal specifically with soil conservation and water control on urban and suburban sites.

There is, however, much information on soil and water conservation methods as applied to agricultural land. The householder with a "do-it-yourself" bent will find a rewarding challenge in adapting these methods to the small-scale urban and suburban areas with which he works.

The following list includes, in addition to the specific references in the text, other publications that discuss soil conservation. Bulletins and pamphlets of the U.S. Department of Agriculture (USDA) are marked by an asterisk. While the supply lasts, free single copies are available on request from the Office of Information, USDA, Washington 25, D.C., and from the local, State, and Federal offices of the Soil Conservation Service. All but the PA's (Program Aids) may also be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. USDA yearbooks are not available from the Department of Agriculture, but they too may be purchased from the Superintendent of Documents.

Approved practices in soil conservation. A. B. Foster. Interstate Printers and Publishers, Inc., Danville, Ill., 380 p. $3.25.

*Better lawns. J. C. Harper II and M. A. Hein. G 51, 32 p. 15¢.

*Conquest of the land through seven thousand years. W. C. Lowdermilk. AB 99, 30 p. 15¢.

Conservation of the camp site. American Camping Association, Bradford Woods, Martinsville, Ind., 36 p. 75¢.

*Farm drainage. L. A. Jones. F 2046, 37 p. 15¢.

*Grass makes its own food. W. R. Frandsen. AB 223, folder. 5¢.

*Grass waterways in soil conservation. M. D. Atkins and J. J. Coyle. L 477, 8 p. 10¢.

*How much fertilizer shall I use? L 307, folder. 5¢.

*How to build a farm pond. W. S. Atkinson. L 259, 8 p. 5¢.

*How to control a gully. C. J. Francis. F 2171, 14 p. 10¢.

*How to recognize erosion in the Northeast. AB 27, 16 p. 15¢.

*Make your farm pond safe: prevent drownings. PA 396, 4 p.

*Making land produce useful wildlife. W. L. Anderson. F 2035, 29 p. 15¢.

Manual for outdoor laboratories. R. L. Weaver, ed. Interstate Printers and Publishers, Inc., Danville, Ill., 81 p. $1.25.

Our garden soils. C. E. Kellogg. Macmillan Co., New York, 232 p. $4.00.

*Sediment is your problem: wasted soil and water. G. M. Brune. AB 174, 16 p. 10¢

*Small watershed projects under the Watershed Protection and Flood Prevention Act. PA 392, 14 p.

*Soil erosion: the work of uncontrolled water. R. D. Hockensmith and J. G. Steele. AB 260, 16 p. 10¢.

*Soils suitable for septic-tank filter fields. W. H. Bender. AB 243, 12 p. 15¢.

Songbirds in your garden. J. K. Terres. Thomas Y. Crowell, New York, 274 p. $3.95.

*Stripcropping for conservation and production. H. E. Tower and H. H. Gardner. F 1981, 46 p. 20¢.

This land of ours: community and conservation projects for citizens. A. H. Hubbard. Macmillan Co., New York, 272 p. $4.95.

*What is a watershed? PA 420, folder.

*Windbreaks in conservation farming. A. E. Ferber. M 759, 22 p. 20¢

*Wood chips for the land. A. C. McIntyre. L 323, 8 p. 5¢.

*Your soil—crumbly or cloddy? A. M. O'Neal and A. A. Klingebiel. L 328, 8 p. 10¢.

*Zoning for rural areas. E. D. Solberg. L 510, folder. 5¢.

USDA YEARBOOKS

Grass: the 1948 yearbook of agriculture. 892 p. $2.00.

Land: the 1958 yearbook of agriculture. 605 p. $2.25.

Soil: the 1957 yearbook of agriculture. 784 p. $2.25.

Trees: the 1949 yearbook of agriculture. 944 p. $2.75.

Water: the 1955 yearbook of agriculture. 751 p. $2.00.

(Prepared by Ben O. Osborn, *Soil Conservation Service*)